



MEMORANDUM

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Water Resources Group

date: October 31, 2001
from: John Craig
phone: (703) 385-6000 ext. 377
to: David Smith, EPA Region 9
cc: Wendy Wiltse, EPA-PICO; June
Harrigan, DOH/EPO
re: Hawaii Data Review

Based on our review of data provided by EPA, we have prepared the attached data summary report. The summary includes basic information on the process and procedures employed to date. We will complete the report after discussing your needs on this afternoons call.

Introduction

Tetra Tech received a CD containing STORET water quality data from EPA region 9. The CD contained MS Excel spreadsheets of data for stations in Hawaii, Oahu, Kauai and Maui. In addition, several reports were received and the data from these reports was entered into Excel spreadsheets. Because of the nature of the data analysis required, the information from each of the spreadsheets was imported into an MS Access database, which streamlined the process of developing queries and statistically analyzing the data. The remainder of this document presents a summary of the water quality criteria used in our analysis, our methodology for assessing the data, and a summary of the results of our analysis.

Summary of Hawaii's Water Quality Standards

The analysis presented in this document was based on the water quality standards (WQS) provided by EPA Region 9. The standards, which are found in *Hawaii Administrative Rules, Title 11, Department of Health, Chapter 54*, are summarized in Table 1. Note that Table 1 only includes parameters for which the standards had clear numeric expressions. Other parameters with narrative standards (e.g., temperature, salinity) are not included. The table also differentiates the seasonal and waterbody type differences associated with Hawaii's standards.

Data Analysis Methodology

Waterbody Types

Because the Hawaii WQS are based on both waterbody type and season, the first step in our analysis required that we associate each station with a waterbody type and that the data analysis be consistent with the appropriate wet and dry season standard. The waterbody type analysis was conducted by calculating the geometric mean of salinity for each station. *Note that the analysis presented in this document was conducted by station, rather than waterbody because the data provided did not include sufficient detail on the station location.* Table 2 presents a summary of the types of waterbodies for each island. The classifying criteria for Table 2 are: inland when salinity<0.5 ppt; estuarine when 0.5<salinity<30 ppt; embayment criteria apply in specific coastal areas (from chapter 54 of Hawaii Water Quality standards) with salinity>=30; open coastal when salinity >=30 and were not included above criteria.

Table 2. Waterbody-type summary

Island	Total Number of Stations	Inland	Estuary	Embayment	Open-Coastal
Hawaii	96	0	51	12	33
Kauai	32	0	9	4	19
Maui	58	0	4	5	49
Oahu	78	4	8	14	51
Total	264	4	73	34	153

Tables 3 to 6 present the stations for each of the waterbody types presented in Table 2. The data analysis for each of the stations presented in Tables 3 to 6 was completed by comparing available data to the applicable criteria presented in Table 1.

Remark Data

In some cases, the data provided include data with remark codes indicating some data qualifier. The most prevalent included STORET codes “K” and “L”, which refer to data reported as less than or greater than the detection limits, respectively. For the data flagged with an “L”, values were always associated with the data and these values were significantly less than the applicable standard. Therefore, for these data, we used the presented value in our analysis of standards attainment. The following summarizes the values observed when the less than detect remark code was included:

- chlorophyll a: 2.5 ug/L
- enterococci: 0.3 to 1 #/100ml
- fecal coliform: 0.7 to 1 #/100ml
- nitrate+nitrite: 0.01 ug/L
- total N: 0.1 ug/L
- total P: 0.0006 to 0.005 ug/L

The only pollutant data with a “K” remark, indicating that the value was too large to measure, were associated with fecal coliform and enterococci. The values presented when the “K” remark was included were 2,000 and 600 for fecal coliform and enterococci, respectively and these values were used in our analyses.

Determination of Seasons

The Hawaii standards are based on waterbody types and stations. The standards indicate that the dry season is from November 1 through April 30 and the wet season is from May 1 through October 30. However, the definition of wet and dry seasons for embayments and open-coastal waters requires information on the quantity of incoming freshwater into the waterbody. Because we do not sufficient information to determine this, we used the season breakdown for the inland waters as a surrogate for determining seasons for the other waterbody types..

Data Analysis

Using MS Access and a software package called Total Access Statistics 2000 (MS Access add-in), summary statistics (geometric mean, 10th percentile, and 2nd percentile) were calculated for each station based on the available data. For most of the parameters, the analysis was straightforward. However, for some parameters, the nature of the standard (narrative) or the lack of sufficient data, made the analysis difficult. The following parameters have not been properly assessed:

- temperature: the standards require comparison to ambient levels
- salinity: the standards require comparison to ambient levels
- dissolved oxygen (% saturation): the standards specify relationship to salinity and temperature, but no specifics are provided.
- enterococci: although the analysis was conducted using available data, no stations had sufficient data

(5 consecutive available observation data within 30 day-period exceeds 7/100ml of enterococci standard) to support comparison to the standard

- fecal coliform: same as for enterococci

Data Summary

To be added

Table 1. Summary of Hawaii Water Quality Standards

Parameter		Inland		Estuary	Embayment		Open-Coastal	
		Wet Season	Dry Season		Wet Season	Dry Season	Wet Season	Dry Season
Ammonia Nitrogen (ug NH ₄ -N/L)	GM 10 th percentile 2 nd percentile	N/A N/A N/A	N/A N/A N/A	6 10 20	6 13 20	3.5 8.5 15	3.5 8.5 15	2 5 9
CHLOROPHYLL A (ug/L)	GM 10 th percentile 2 nd percentile	N/A N/A N/A	N/A N/A N/A	2 5 10	1.5 4.5 8.5	0.5 1.5 3	0.3 0.9 1.75	0.15 0.5 1
Nitrite + Nitrate Nitrogen (ug/L as N)	GM 10 th percentile 2 nd percentile	70 180 300	30 90 170	8 25 35	8 20 35	5 14 25	5 14 25	3.5 10 20
Total N (ug/L AS N)	GM 10 th percentile 2 nd percentile	250 520 800	180 380 600	200 350 500	200 350 500	150 250 350	150 250 350	110 180 250
Total P (ug/L AS P)	GM 10 th percentile 2 nd percentile	50 100 150	30 60 80	25 50 75	25 50 75	20 40 60	20 40 60	16 30 45
Turbidity, NTU	GM 10 th percentile 2 nd percentile	5 15 25	2 5.5 10	1.5 3 5	1.5 3 5	0.4 1 1.5	0.5 1.25 2	0.2 0.5 1
TSS (mg/L)	GM 10 th percentile 2 nd percentile	20 50 80	10 30 55	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A
Light extinction coefficient	GM 10 th percentile 2 nd percentile	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A	0.2 0.5 0.85	0.1 0.3 0.55
Enterococci (#/100ml)*	GM Not to exceed							
Fecal coliform (#/100ml)**	GM Not to exceed							

GM: geometric mean

Table 3. Stations Classified as Inland	
Station Number	Station Name
Oahu ALWS06 ALWS03 ALWS04 ALWS02	MAKIKI STREAM (JACK-IN-THE-BOX) MANOA STREAM FORK MANOA-PALOLO STREAM (KHS) PALOLO STREAM FORK

Table 4 Stations Classified as Estuaries

Station Number	Station Name
Hawaii	
KAHO_UH97_F5	AIMAKAPA'A FISHPOND ON HAWAII NEAR KAILUA KONA
KAHO_UH97_F6	AIMAKAPA'A FISHPOND ON HAWAII NEAR KAILUA KONA
KAHO_UH97_F7	AIMAKAPA'A FISHPOND ON HAWAII NEAR KAILUA KONA
KAHO_UH97_F8	AIMAKAPA'A FISHPOND ON HAWAII NEAR KAILUA KONA
KAHO_UH97_82	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_55	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_75	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_51	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_15	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_13	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_17	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_18	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_62	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_6	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_47	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_27	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_26	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_19	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_1	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
KAHO_UH97_65	ANCHIALINE POOL ON HAWAII NEAR KAILUA KONA
001101	COCONUT ISLAND
001102	EXIT OF ICE POND
001200	HAPUNA BEACH
001106	HILO BAY (BOAT LANDING)
001138	HILO BAY (CANOE BEACH)
001107	HILO BAY (LIGHTHOUSE)
001201	HONAUNAU BAY (CITY OF REFUGE)
001110	HONOLII COVE (OCEAN)
001202	HONUPO LANDING
001203	KAHALUU BEACH
001204	KAILUA PIER STATION A
001208	KAILUA PIER STATION D
KAHO_UH97_F1	KALOKO FISHPOND ON HAWAII NEAR KAILUA KONA
001113	KAPOHO BEACH LOTS #1
001114	KEAUKAHA BEACH-4 MILES
001118	KOLEKOLE GULCH (STREAM)
001121	LELEIWI BEACH PARK
001218	MAUNA KEA HOTEL-OFF 4TH GREEN
KAHO_UH97_M1	OFFSHORE 10 M FROM KALOKO FISHPOND ON HAWAII
001126	ONEKAHAKAHA BEACH-SWIMMING AREA
001127	POHOIKI
001223	PUAKO BEACH LOTS-FAR END OF LOT
001222	PUAKO BEACH LOTS-MIDDLE OF LOT
001143	PUALAA BEACH PARK
001129	PUHI BAY #2
001224	PUNALUU
001139	RICHARDSON OCEAN CENTER (HILO SIDE BEACH)
001225	SPENCER PARK BEACH
001132	WAILOA RIVER (BOAT RAMP)

Table 4 Stations Classified as Estuaries

Station Number	Station Name
Kauai 000804 000839 000806 000811 000837 000817 000822 000823 000825	HANALEI BAY LANDING HANALEI RIVER (END OF WEKE ROAD) HANAMAULU BEACH (MIDDLE) KALIHIWAI BAY BEACH KOLOA LANDING NAWIWILI HARBOR-COAST GUARD PIER WAILUA RIVER WAIMEA BAY BEACH (NEAR RIVER) WEST OF LYDGATE PARK WADING POOL
Maui 000653 000700 000653 000706 000654	HONOMANU BAY SPRECKELSVILLE BEACH HONOMANU BAY HARBOR LIGHTS HUKILAU HOTEL SHORELINE
Oahu 000320 ALWS01 BELLOWS#5 000171 000302 000178 000190 ALWS05 000321	ALA MOANA BRIDGE ALA WAI CANAL DIAMOND HEAD END BELLOWS BEACH (WAIMANALO STREAM MOUTH) HALEIWA BEACH PARK KAELEPULU STREAM KAHANA PARK KANEOHE BEACH PARK MANOA-PALOLO STREAM MOUTH MCCULLY STREET BRIDGE

Table 5. Stations Classified as Embayment	
Station Number	Station Name
Hawaii 001236 001141 001205 001206 001207 001230 001212 001211 001213 001231 001221	ANAHOOMALU BAY HILO BAY (OFF SHORE) KAILUA PIER A-1 KAILUA PIER STATION B KAILUA PIER STATION C KEALAKEKUA BAY (EMBAYMENT) KEALAKEKUA BAY-OFF CANOE LANDING KEALAKEKUA BAY-OFF CURIO STAND KEAUHOU BAY KEAUHOU BAY (EMBAYMENT) PUAKO BEACH LOTS-BOAT RAMP
Kauai 001236 001141 001205 001206 001207 001230 001212 001211 001213 001231 001221	ANAHOOMALU BAY HILO BAY (OFF SHORE) KAILUA PIER A-1 KAILUA PIER STATION B KAILUA PIER STATION C KEALAKEKUA BAY (EMBAYMENT) KEALAKEKUA BAY-OFF CANOE LANDING KEALAKEKUA BAY-OFF CURIO STAND KEAUHOU BAY KEAUHOU BAY (EMBAYMENT) PUAKO BEACH LOTS-BOAT RAMP
Maui 000680 000659 000657	KAHULUI BAY MAALAEA SMALL BOAT HARBOR LAHAINA SMALL BOAT HARBOR
Oahu 000213 000201 000444 000362 000170 000403 000402 000401 000342 000361 000452 000451 000224	BARBER'S POINT BEACH PARK HANAUMA BAY HANAUMA BAY (OCEANIC) HEEIA KEA SMALL BOAT HARBOR KAIKA BAY Kaneohe Bay (Central Region) Kaneohe Bay (Northern Region) Kaneohe Bay (Southern Region) KEEHI LAGOON POINT X KEWALO BASIN POKAI BAY (OCEANIC) POKAI BAY (OPEN COASTAL) POKAI BAY (SHORELINE)

Table 5. Stations Classified as Open-Coastal

Station Number	Station Name
Hawaii	
001235	BANYAN'S SURFING AREA
KAHO_UH97_F2	KALOKO FISHPOND ON HAWAII NEAR KAILUA KONA
KAHO_UH97_F4	KALOKO FISHPOND ON HAWAII NEAR KAILUA KONA
KAHO_UH97_F3	KALOKO FISHPOND ON HAWAII NEAR KAILUA KONA
001209	KAUHAKE BAY-HOOKENA
001238	KAWAIHAE HARBOR
001210	KAWAIHAE HARBOR PIER
001234	KEAHOLE POINT (OCEANIC)
001116	KEOKEA BAY BEACH PARK
001214	KONA HILTON SHORELINE
001120	LAUPAHOEHOE POINT (BOAT RAMP)
001215	MAGIC SANDS BEACH
001216	MAHUKONA LANDING
001217	MAUNA KEA BEACH HOTEL-OUTFALL
001219	MAUNA KEA HOTEL BEACH
001220	MILOLII
KAHO_UH97_M2	OFFSHORE 100 M FROM KALOKO FISHPOND ON HAWAII
KAHO_UH97_M3	OFFSHORE 100 M FROM KALOKO FISHPOND ON HAWAII
KAHO_UH97_M7	OFFSHORE 100M FROM AIMAKAPA'A FISHPOND ON HAWAII
KAHO_UH97_M8	OFFSHORE 100M FROM AIMAKAPA'A FISHPOND ON HAWAII
KAHO_UH97_M6	OFFSHORE 10M FROM AIMAKAPA'A FISHPOND ON HAWAII
KAHO_UH97_M4	OFFSHORE 200 M FROM KALOKO FISHPOND ON HAWAII
KAHO_UH97_M5	OFFSHORE 200 M FROM KALOKO FISHPOND ON HAWAII
KAHO_UH97_M9	OFFSHORE 200M FROM AIMAKAPA'A FISHPOND ON HAWAII
KAHO_UH97_M10	OFFSHORE 200M FROM AIMAKAPA'A FISHPOND ON HAWAII
001128	PUHI BAY #1
001130	PUHI BAY #3
001136	RICHARDSON OCEAN CENTER
001142	VACATIONLAND
Kauai	
000803	HAENA BEACH
000809	KALAPAKI BEACH (MIDDLE)
000811	KALIHUWAI BAY BEACH
000812	KAPAA PAVILION
000813	KEALIA BEACH
000835	KEE BEACH
000814	KEKAHA (OOMANO POINT)
000841	KEONILOA BAY
000837	KOLOA LANDING
000836	LAWAI BEACH RESORT
000818	NORTH END OF WAILUA BEACH
000829	NUKOLII BEACH
000819	POIPU BEACH PAVILION
000820	POLIHAE BEACH
000838	SHERATON BEACH
000840	WAIMEA BAY
000833	WAIOLI BEACH PARK
000824	WAIPOULI BEACH

Table 5. Stations Classified as Open-Coastal

Station Number	Station Name
Maui	
000684	KIHEI BOAT RAMP
000676	KIHEI (SOUTH)
000671	KIHEI (NORTH)
000703	COVE PARK
000677	KANAHA BEACH PARK
000655	KAA SHORELINE
000660	MAHINAHINA CONDO. SHORELINE
000699	KUAU (BEACH ACCESS 402)
000652	HANA BAY
000702	MAI PONIA OE IAU
000650	FLEMING BEACH
000679	KALAMA BEACH
000665	SEVEN POOLS
000669	WAILUKU BREAKWATER
000692	KAOPALA BAY
000642	KALAELOA HARBOR
000664	PAIA OUTFALL
000681	KAMAOLE BEACH #1
000701	KIHEI LANDING
000651	HALE ONOLOA CONDOMINIUM SHORE
000688	HOOKIPA
000630	MANELE SM BT HARBOR
000687	MAALEA CONDO
000641	KAUNAKAKAI HARBOR
000689	H.A. BALDWIN PARK
000631	HULOPOE BAY
000678	WAIHIKULI BEACH
000662	MALA WHARF
000674	FLEMMING BEACH (NORTH)
000693	HANAKAOO BEACH PARK
000683	KAMAOLE BEACH #3
000698	UKUMEHAME BEACH
000682	KAMAOLE BEACH #2
000668	WAIHEE FARM SHORELINE
000690	NEHE POINT
000675	WAIOPAI
000686	ULUA BEACH
000667	WAIHEHU STREAM MOUTH
000666	SHERATON KAA NAPALI SHORELINE
000663	LOWALU SHORE FRONT
000695	AIRPORT (KAHEKILI) BEACH
000685	KEAWEKAPU BEACH
000661	MAKENA BEACH
000691	WAI LEA BEACH
000694	LAUNIUPOKO WAYSIDE PARK
000704	KEAWAKAPU (2)
000697	TEEN CHALLENGE (MI 14)
000696	PUUNOA (BABY) BEACH
000705	POLO BEACH

Table 5. Stations Classified as Open-Coastal

Station Number	Station Name
Oahu	
000153	ALA MOANA PARK CENTER
000154	ALA MOANA PARK DIAMOND HEAD END
000152	ALA MOANA PARK EWA END
000800	ANAHOLA BAY PAVILION
000801	ANINI PARK PAVILION
BELLOWS#6	BELLOWS BEACH (LIFEGUARD STAND)
BELLOWS#4	BELLOWS BEACH (NORTH RUNWAY)
BELLOWS#1	BELLOWS BEACH (SOUTH OF ROCKS)
BELLOWS#3	BELLOWS BEACH (SOUTH RUNWAY)
000223	BLAISDELL PARK
000802	BRENNECKE BEACH
000218	CHUN'S REEF
000189	EWA BEACH PARK
000158	FORT DERUSSY BEACH
000159	GRAY'S BEACH
000176	HAUULA BEACH PARK
000229	HAWAII KAI
000155	KAHANAMOKU BEACH
000157	KAHANAMOKU LAGOON-DIAMOND HEAD
000206	KAILUA BAY OUTFALL
000193	KAILUA PARK BEACH
000227	KAIONA BEACH
000207	KALAMA BEACH
000173	KEWELA BAY
000191	KOKOKAHI PIER
000208	KUALOA BEACH PARK
000161	KUHIO BEACH
000175	LAIE BAY
000194	LANIKAI BEACH
000185	MAKAHA
000216	MAKAPUU BEACH
000221	MALAEKAHANA BEACH PARK
000442	MAMALA BAY (OCEANIC)
000441	MAMALA BAY (SAND ISLAND OFF SHORE)
000443	MAUNALUA BAY (OPEN COASTAL)
000169	MOKULEIA
000187	NANAKULI BEACH PARK
000304	ONEAWA BEACH
000162	PUBLIC BATH BEACH
000165	SAND ISLAND POINT #2
000200	SANDY BEACH POINT #1
000228	SANS SOUCI BEACH
000225	SUNSET BEACH
000160	TAVERN BEACH
000214	WAIALAE-KAHALA BEACH
000196	WAIMANALO BAY
000197	WAIMANALO BEACH
000226	WAIMANALO STATE PARK
000172	WAIMEA BAY
000215	YOKOHAMA BEACH